Modelling Current and Global Warming-Induced Fire Risk in Africa

F. Justino[1], F. Stordal[2], A. Clement[3], E. Coppola[4], A. Setzer[5], D. Brumatti[1]

[1] Universidade Federal de Viçosa

Departamento de Engenharia Agrícola

P.H.Holfs S/N, Viçosa, MG, Brazil

corresponding author: fjustino@ufv.br

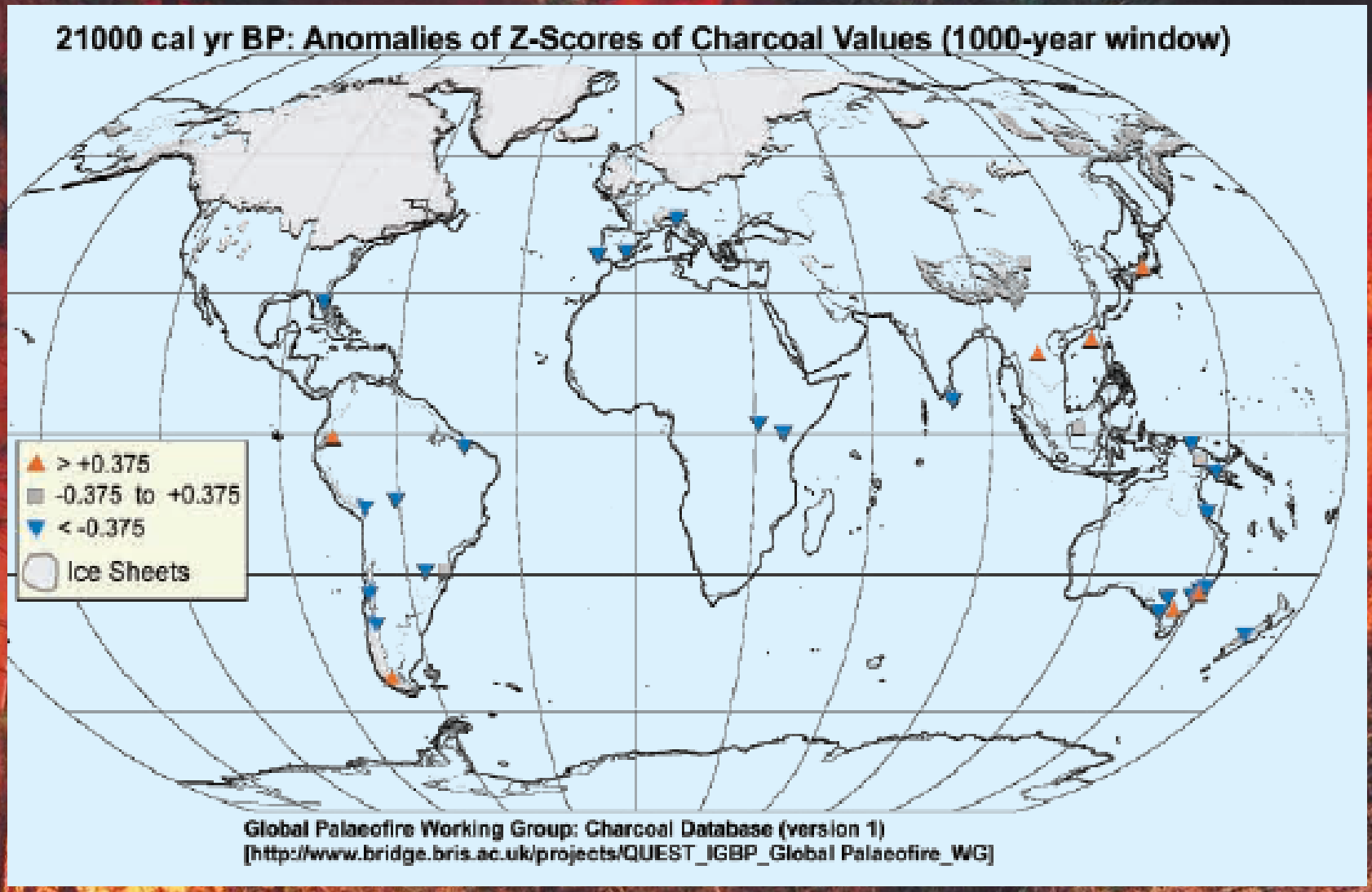
Motivation

- Fire is the second largest source of greenhouse gases emission

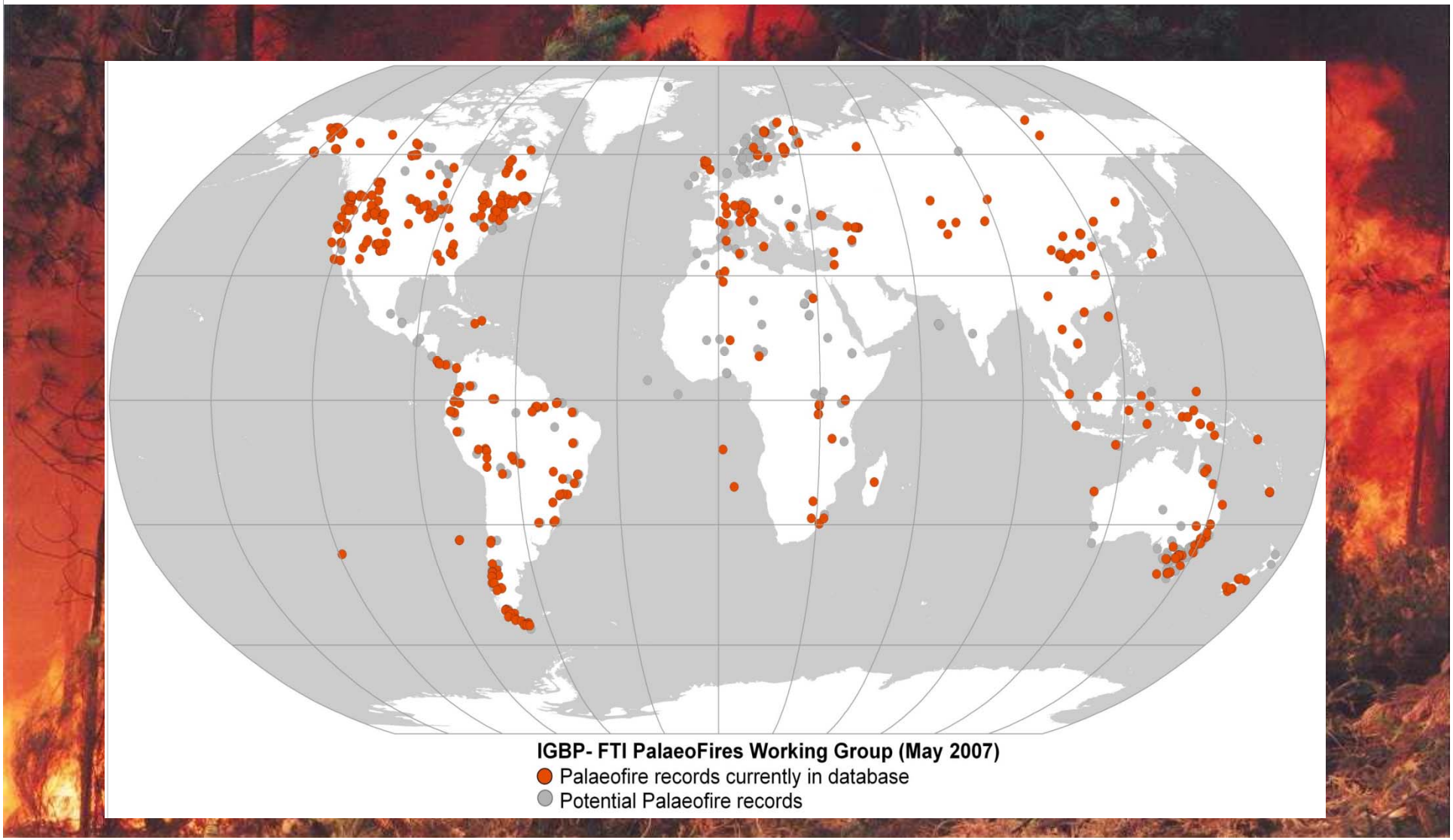
- Fire activity plays an important role in defining the Earth's ecosystems and dominant plant communities (e.g. Pyne et al., 1996, Meyn et al., 2007).

-There exists a lively debate on the importance of anthropogenic and climate forcing in contributing to the ignition of wild-land fires.

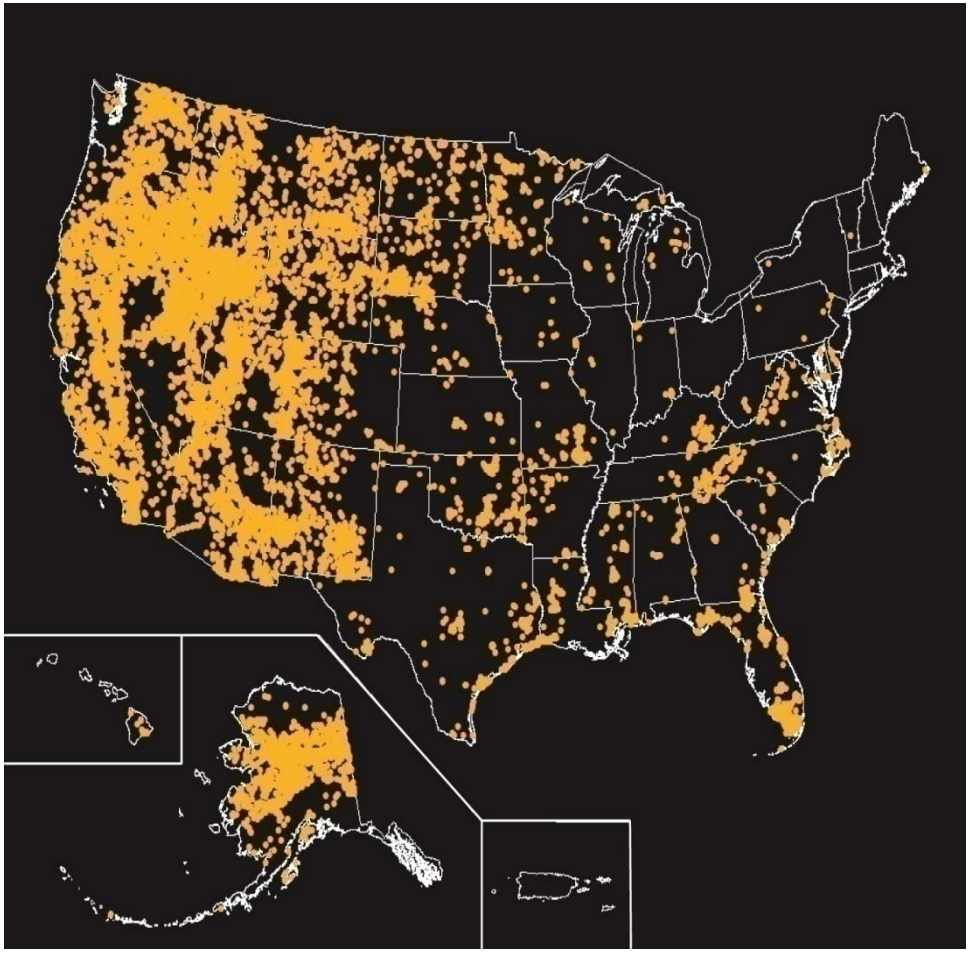
Vegetation Fires (20000 BP)



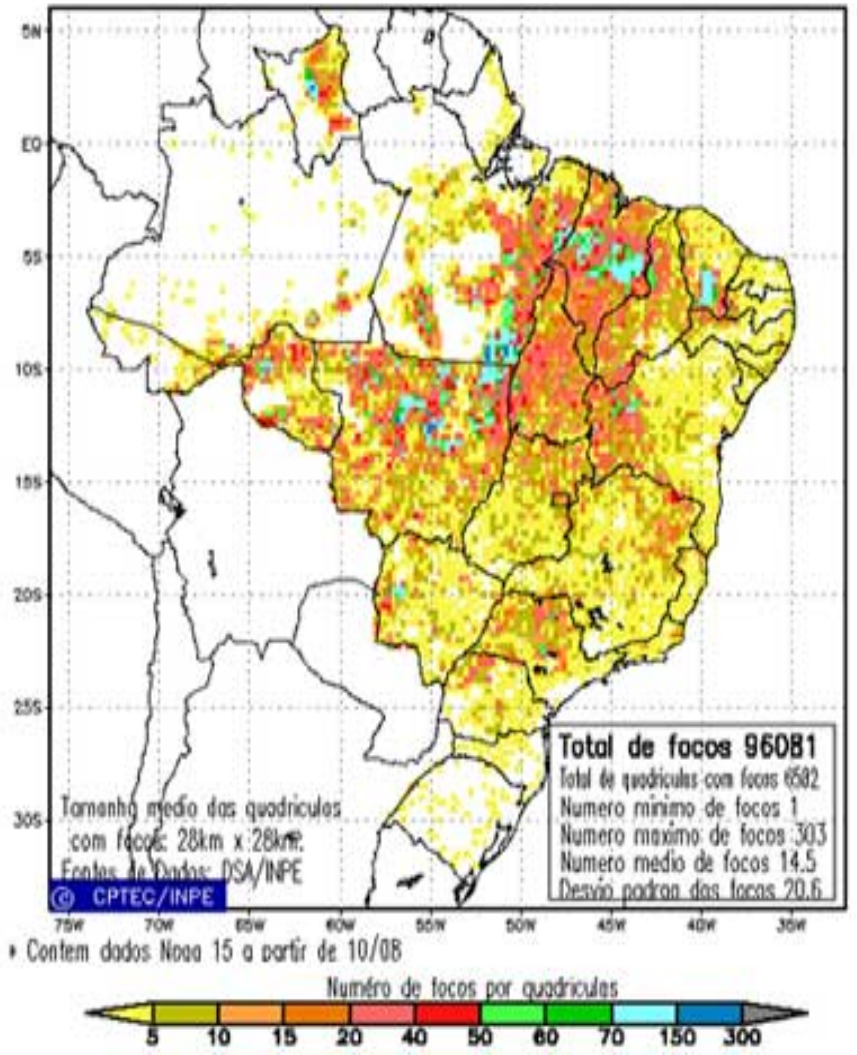
Vegetation Fires (6000 BP)



Vegetation fires (USA-climate)



Anthropogenic Vegetation Fires (Brazil)



Design of the numerical experiments

RegCM3 Model ⟨ Ensemble Project Mariotte et al (2011)

120 years Simulation – 1980 -2100
Based on A1b scenario
Echam5-MPI/OM Boundary Conditions

The potential fire risk is based on:

1. Precipitation Factor
2. Vegetation
3. Maximum Temperature
4. Minimum Relative Humidity

PRECIPITAÇÃO FACTOR (PSE)

prec = acumulated precipitation

$$FP_1 = \exp(-0{,}14prec) \qquad FP_2 = \exp(-0{,}07prec)$$

$$FP_3 = \exp(-0{,}04prec) \qquad FP_4 = \exp(-0{,}03prec)$$

$$FP_5 = \exp(-0{,}02prec) \qquad FP_{6a10} = \exp(-0{,}01prec)$$

$$FP_{11a15} = \exp(-0{,}008prec) \qquad FP_{16a30} = \exp(-0{,}004prec)$$

$$FP_{31\,a\,60} = \exp(-0{,}002prec) \qquad FP_{61a90} = \exp(-0{,}001prec)$$

$$FP_{91a120} = \exp(-0{,}0007prec)$$

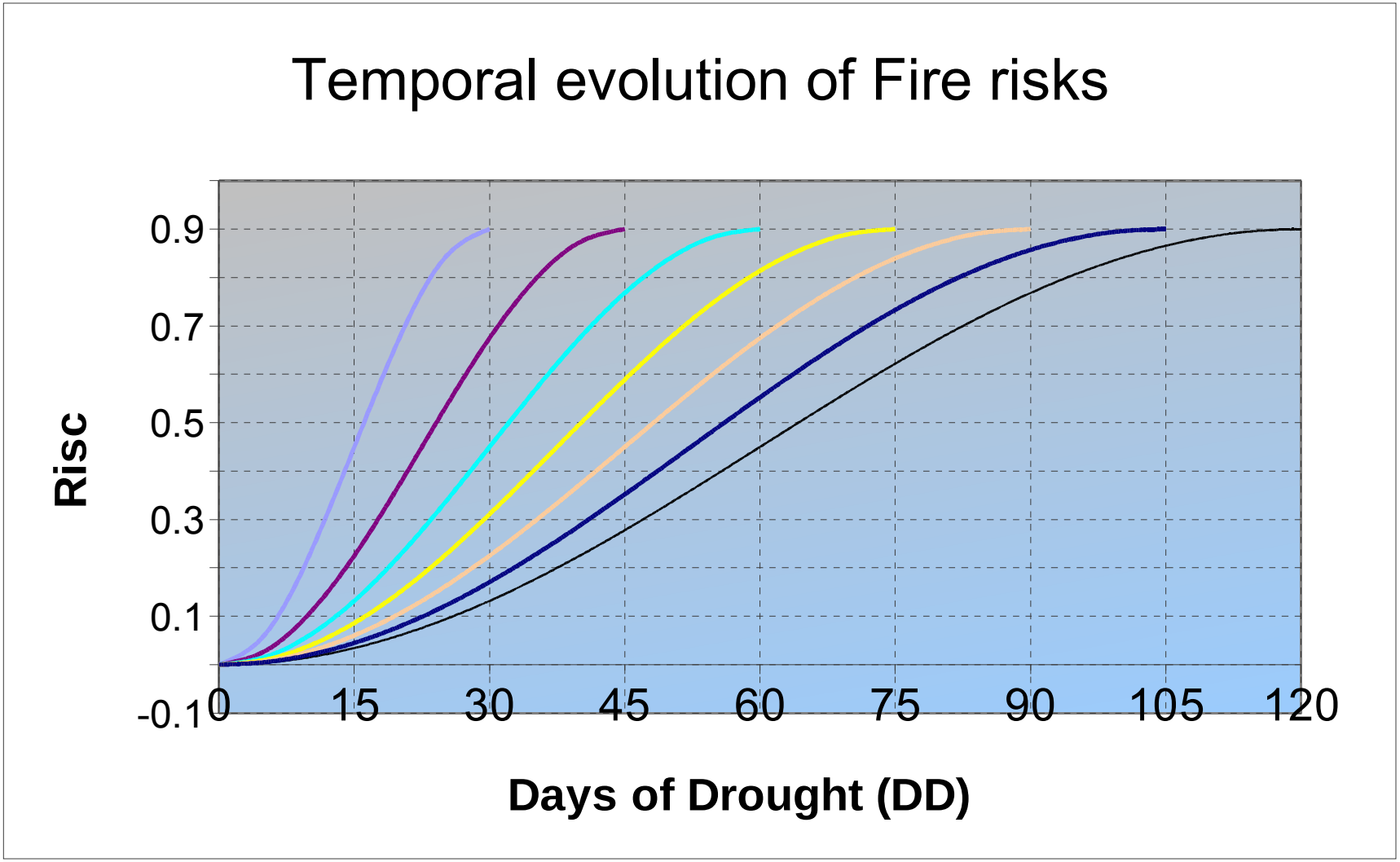
$$PSE = 105 . FP1 . FP2 \ldots FP91a120$$

Vegetation class (IPF)

Setzer *et al.*, 2011

Classes vegetação_IGBP	nome das classes	Ordem Risco	Cte."A"
0	Water	0	- x -
1	Evergreen Needleleaf forest	5	2
2	Evergreen Broadleaf forest	7	1,5
3	Deciduous Needleleaf forest	5	2
4	Deciduous Broadleaf forest	6	1,72
5	Mixed forest	5	2
6	Closed shrublands	4	2,4
7	Open shrublands	3	3
8	Woody savannas	4	2,4
9	Savannas	3	3
10	Grasslands	1	6
11	Permanent wetlands	0	1,5
12	Croplands	2	4
13	Urban and built-up	0	- x -
14	Cropland/Natural vegetation mosaic	2	4
15	Snow and ice	0	- x -
16	Barren or sparsely vegetated	0	- x -

$$RB_{n=1,5} = 0,9[1+\text{sen}(A_{n=1,5} . PSE)]/2$$



Justino et et al
2012 submitted

RU = URmím

RT = Tmáx

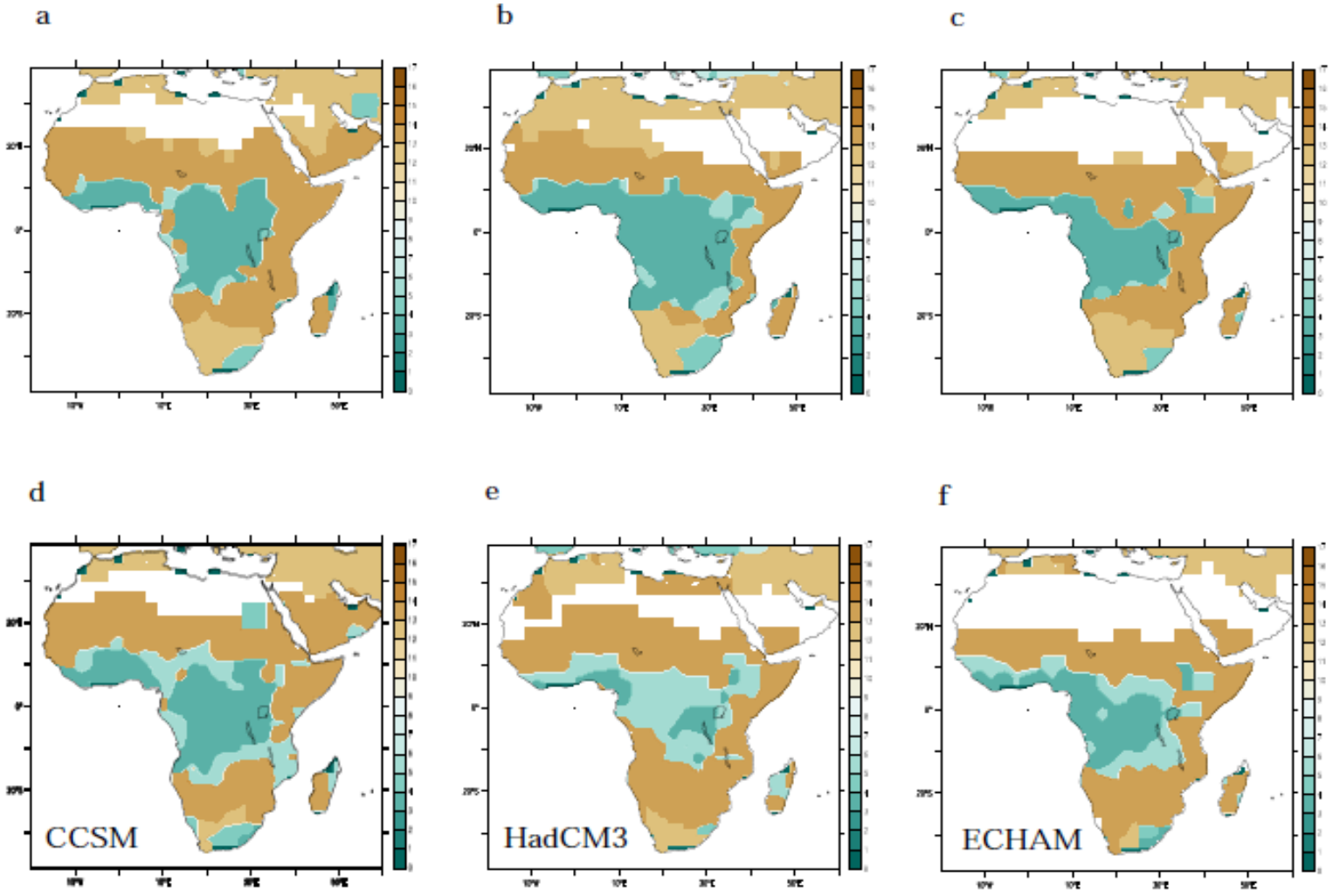
$$RB_{n=1,5} = 0,9[1+\text{sen}(A_{n=1,5}.PSE)]/2$$

$$RU = RB(-0,006.UR_{mín}+1,3)$$

Ptential Fire Risk

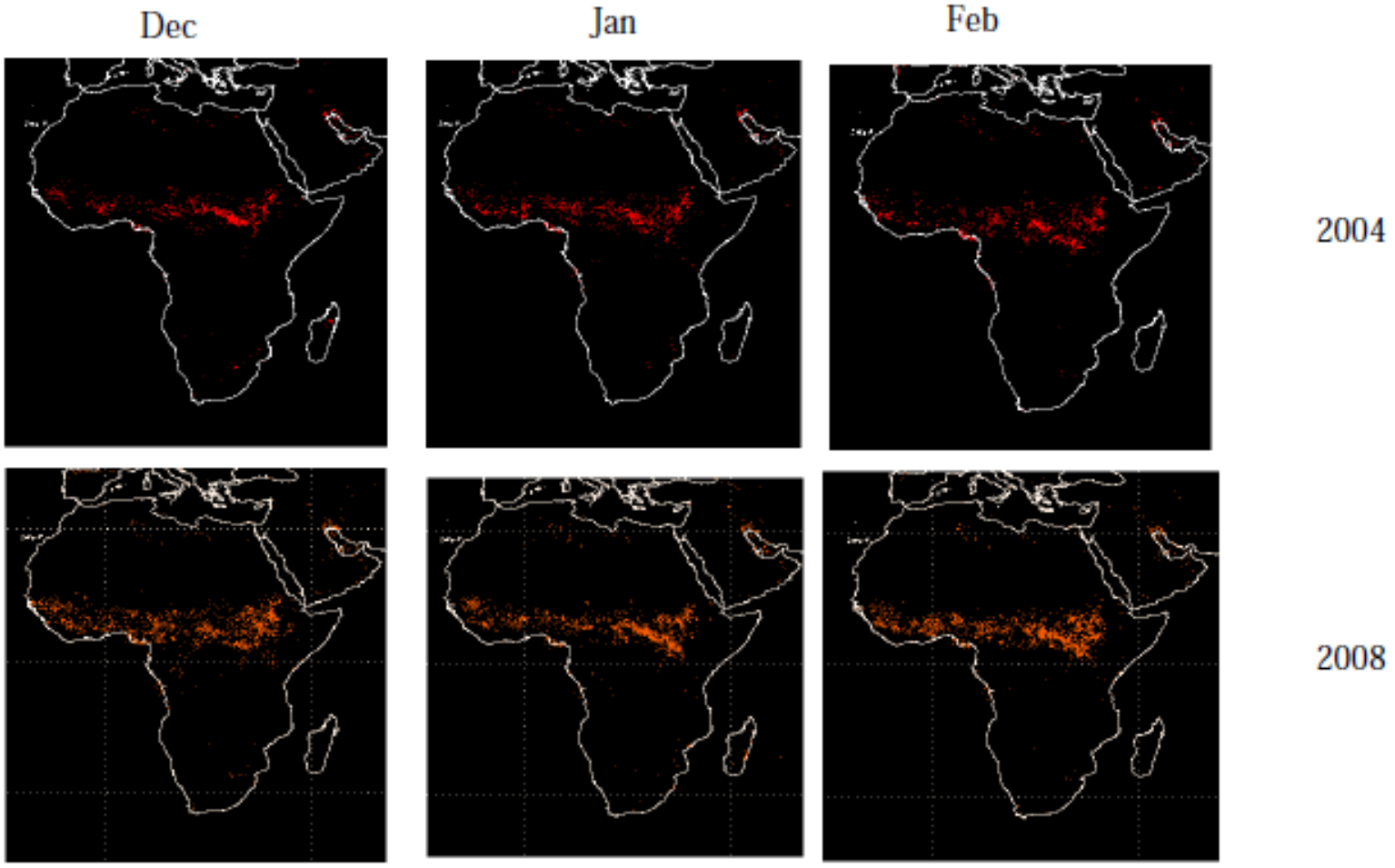
$$RT = RU(0,02T_{máx}+0,4)$$

Modelling Present day and Future Vegetation in Africa

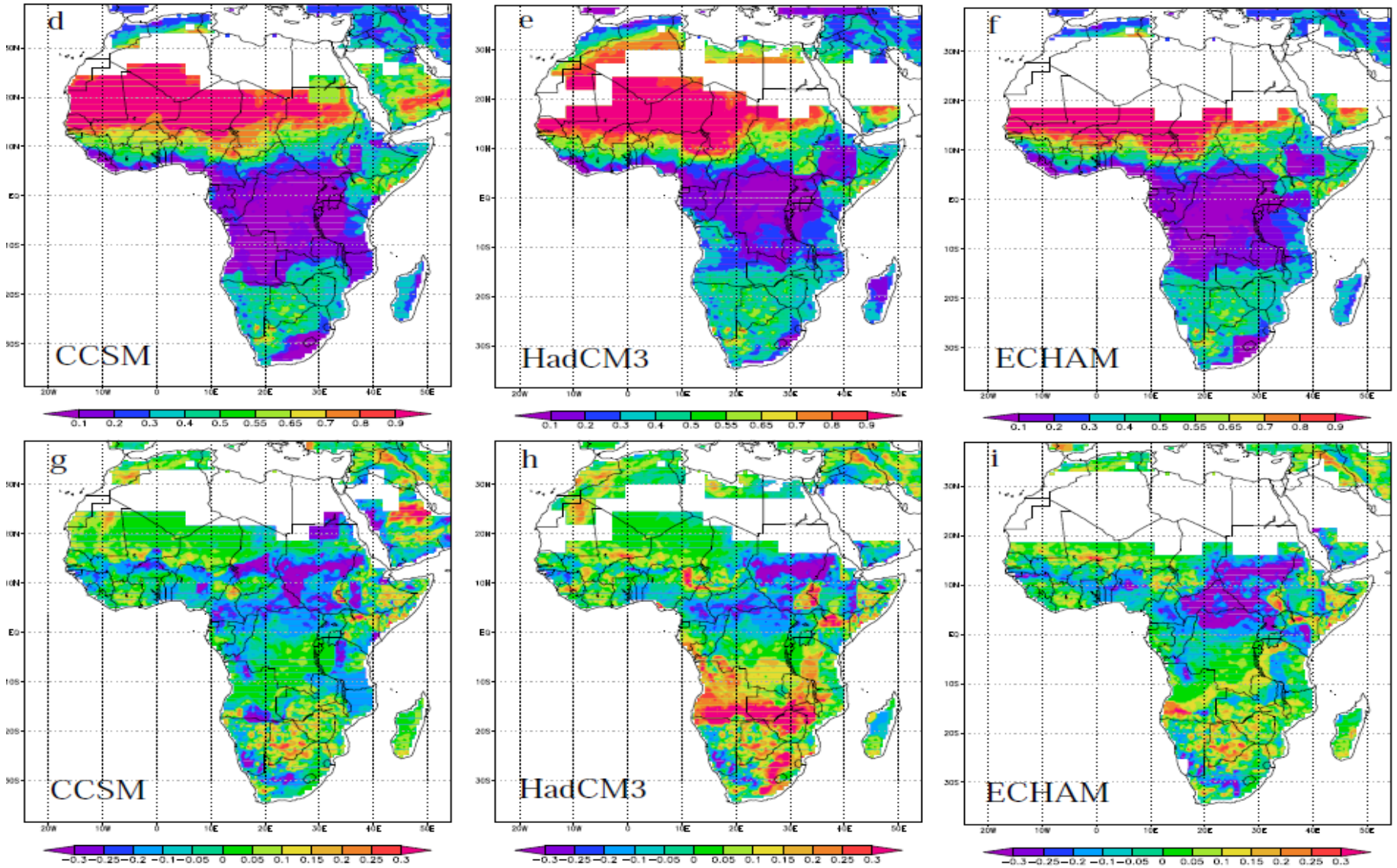


Alo et al 2010

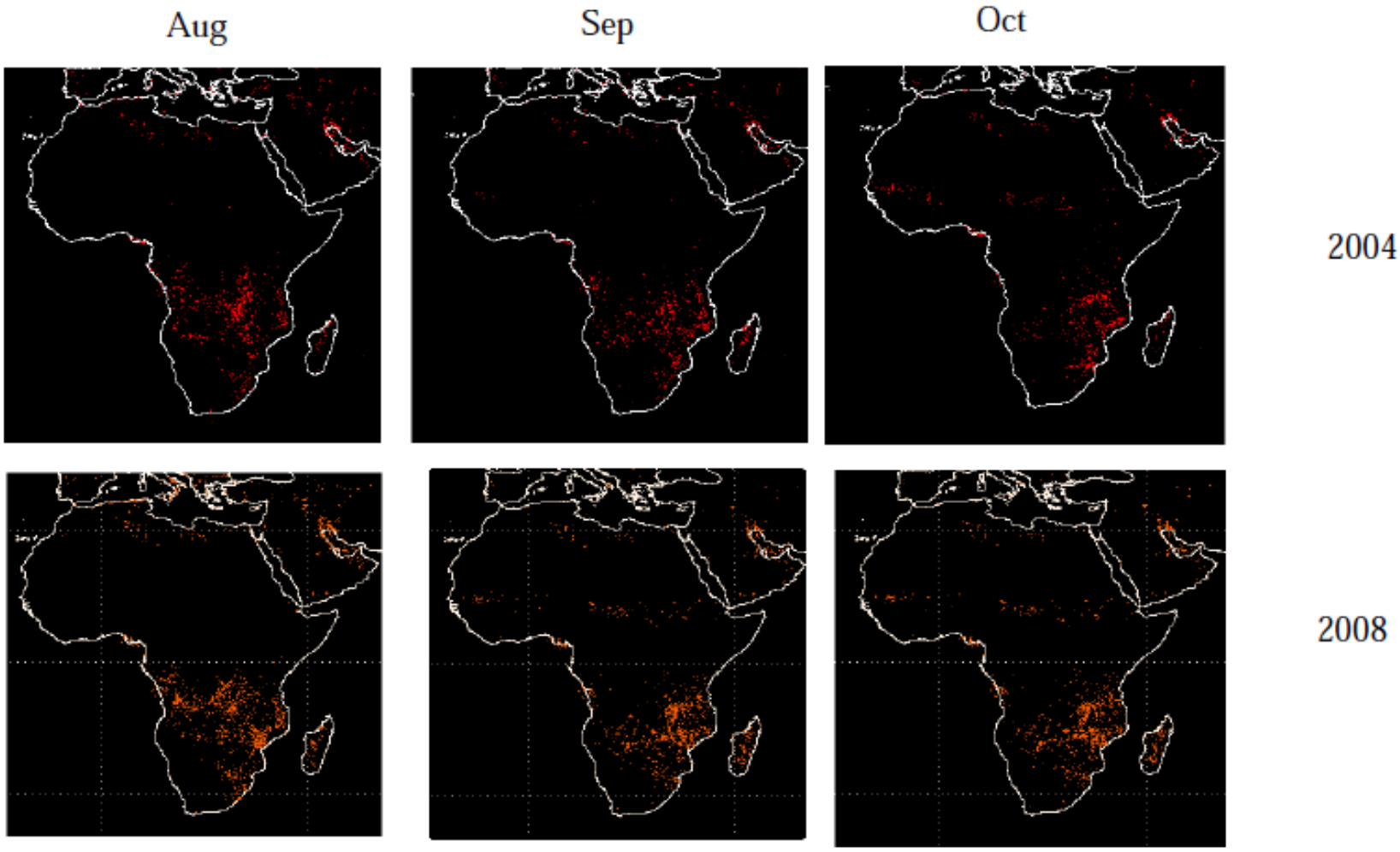
Real hot spots



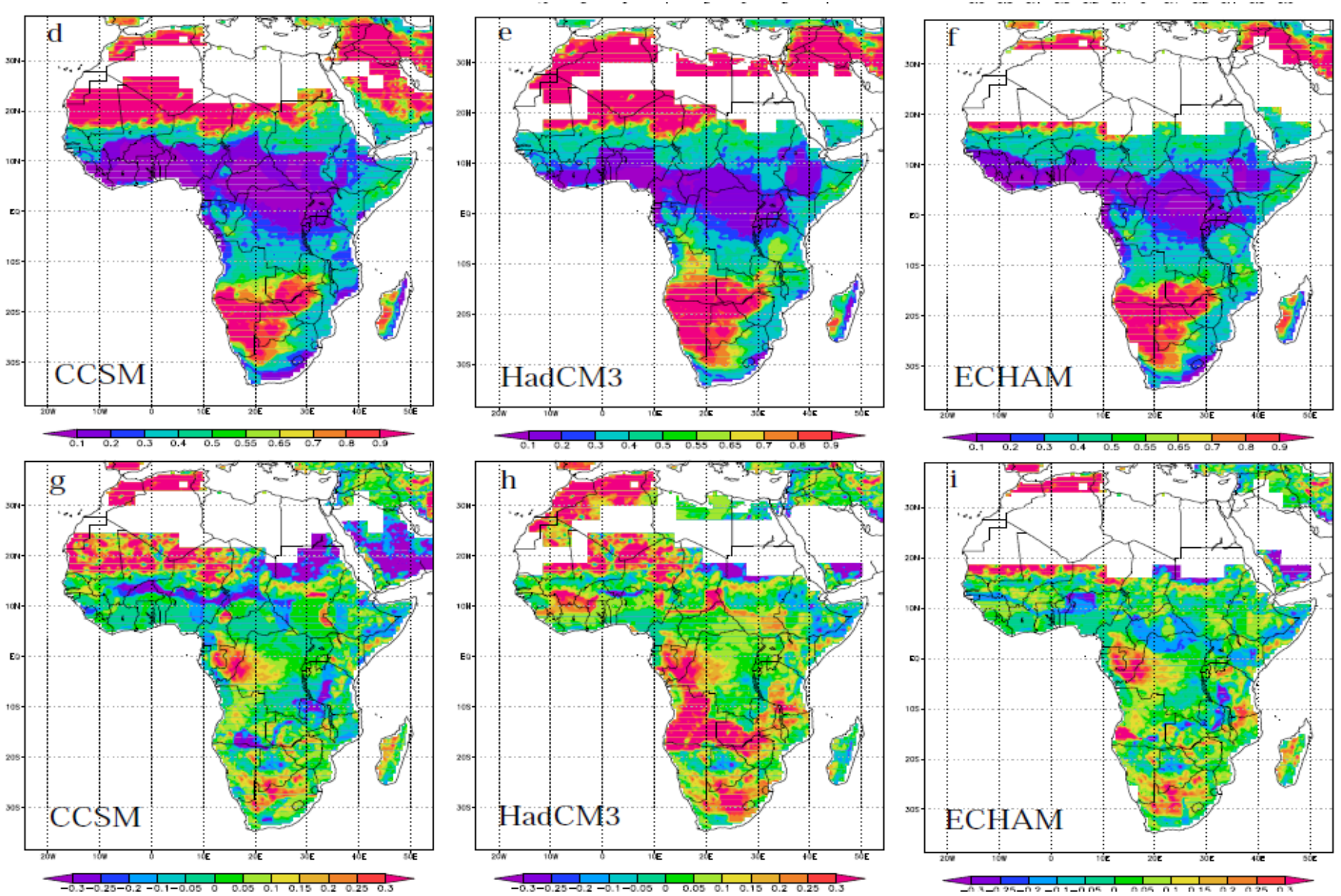
December, January and February



Real Hot Spots



August, September and October



Flavio Justino
fjustino@ufv.br

Obrigado